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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/894,186	06/28/2001	Yuen Chuen Chan	774-010087-US (PAR)	5310

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EXAMINER	
SONG, MATTHEW J	
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1765	6

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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 09/894,186	Applicant(s) CHAN ET AL.	
	Examiner Matthew J Song	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 June 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 10 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 10 cites the limitation of semiconductor epitaxial layers comprise III-IV epitaxial layers, the specification is silent to III-IV semiconductor layers. The examiner suggests the applicant changes "III-IV" to "III-V".

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-11 recites the limitation "the system" in line 14 of claim 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1 and 8-11 are rejected under 35 U.S.C. 102(a) as being anticipated by Mao et al ("New Concept Technology Pressure-Variation Liquid Phase Epitaxy, July 2000).

Mao et al discloses pressure-variation liquid phase epitaxy, where supersaturation in the growth solution is realized by changing the growth pressure (pg 2). Mao et al also discloses the basis of liquid phase epitaxy, where a growth solution is supersaturated such that a deposition of solid material occurs onto a substrate (pg 2). Mao et al also discloses GaSb growth with pressure-variation liquid phase epitaxy and GaSb growth is difficult at temperatures below 500°C with pressure variation liquid phase epitaxy (pg 5). Mao et al also discloses a slider and boat is movable when the pressure is standard atmosphere pressure and varying pressure is ued to realize supersaturation even though the growth temperature is kept constant. (pg 11).

Referring to claim 1, the examiner interprets growth pressure to read on applicant's limitation of pressure of the system.

Referring to claim 8, Mao et al discloses it is difficult to form a GaSb film below 500°C with pressure variation LPE.

Referring to claim 9, Mao et al discloses a constant growth temperature.

Referring to claim 10, the examiner interprets claim 10 to read as a III-V semiconductor layer. Mao et al discloses GaSb.

Referring to claim 11, Mao et al discloses GaSb.

7. Claims 1 and 8-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishizawa (US 4,692,194).

Nishizawa discloses a method of performing solution growth of a GaAs compound, where a substrate crystal **14** set in a recess formed in a slider **3** and growth of a crystal is started by moving the slider and by contacting a melt with the substrate (col 4, ln 35-40). Nishizawa also discloses a vapor pressure of As which is introduced during the growth process is controlled by a vapor pressure control furnace and in the range of 1 torr to 1000 torr (col 3, ln 50-65 and claim 3) and an epitaxial growth was conducted on a substrate by varying the As vapor pressure which is applied under a constant growth temperature of 820°C (col 5, ln 10-30). Nishizawa also discloses the a layer with high crystallographic quality is obtained because the deviation from the stoichiometric composition can be minimized owing to the fact that the crystal growth is preformed at a completely constant temperature and that the vapor pressure is controlled (col 4, ln 49-56).

Nishizawa is silent to the growth solution being under a supersaturated condition such that a first layer grows on the surface of the substrate. It is inherent to Nishizawa to have the growth solution under a supersaturated state because Nishizawa discloses a crystal is grown on the substrate by contacting the substrate with a melt, as applicant.

Nishizawa is silent to varying the pressure of the system to change the degree of supersaturation of the first growth solution of a growth solution to affect the growth of the first layer. It is inherent to Nishizawa to change the degree of supersaturation because Nishizawa discloses varying the pressure of the system, as applicant, and variations in pressure inherently affect the degree of supersaturation.

Referring to claim 1, the examiner interpretes the system the vapor pressure of As during the growth process to read on applicant's pressure of the system.

Referring to claim 8, Nishizawa discloses a growth temperature of 820°C.

Referring to claim 9, Nishizawa discloses a growth temperature of 820°C.

Referring to claim 10, Nishizawa discloses a GaAs epitaxial layer.

8. Claims 1 and 9 are rejected under 35 U.S.C. 102(b) as being anticapated by Bauser et al (US 5,503,103).

Bauser et al a crucible **10** contains a reservior **3** for keeping a liquid melt solution **7**, where this reservoir is filled to such a degree, that a substrate and solution are brought into contact by the rotation of the crucible **10** (col 3, ln 5-40). Bauser et al also discloses the pressure can be regulated by the rpm of a centrifuge and the rpm leads to a local supersaturation of the solution at the interface with the substate, where a crystalline layer **11** grows on the substrate. (col 4, ln 20-40 and col 3, ln 40-60). Bauser et al also teaches the crystalline layer grows completely isothermally (col 4, ln 55-67).

Referring to claim 1, the examiner interprets the pressure changes to the solution caused by the rotation of the centrifuge to read on applicant's varying the pressure of the system

Referring to claim 9, Bauser et al teaches the growth is completed isothermally

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1-2, 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103).

Bernardi discloses a reactor under a hydrogen flow maintained at atmospheric pressure (col 3, ln 35-40) and a growth solution at a temperature of 485°C, this reads on applicant's temperature above the saturation temperature, and by reducing to the solution temperature of 470°C a crystal layer is deposited on a substrate, this reads on applicant's temperature at or below the saturation temperature (col 5, ln 40-67). Bernardi also discloses at a 2 or 3 degree lower temperature for a supersaturation condition allowing growth to start is obtained (col 5, ln 45-55 and Fig 3).

Bernardi discloses lowering temperature to achieve a supersaturation condition. Bernardi does not disclose varying pressure to bring the solution to supersaturation.

In a solution growth method for synthesizing crystals, Dugger teaches the degree of supersaturation can be changed by changes in the pressure of the solution or controlled by a temperature of the solution (col 3, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Bernardi with Dugger's pressure change to bring the solution to supersaturation because operating isothermally avoids undesirable temperature gradients in the melt forming crystals on the sidewalls of the reactor.

Referring to claim 1, the examiner interpretes changes in the pressure of the solution to read on applicant's pressure of the system.

Referring to claim 9, the combination of Bernardi and Dugger teaches a temperature of 470°C and varying pressure to achieve supersaturation at 470°C.

11. Claims 3-4 and 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103) as applied to claims 1-2 above, and further in view of Cook (US 4,519,871).

The combination of Bernardi and Dugger teaches all of the limitations of claim 3, as discussed previously in claims 1 and 2, except providing a second growth solution.

In a method of liquid phase epitaxy, Cook teaches a first solution is contacted with a substrate in a channel and an epitaxial layer of a first composition is grown to a desired thickness by liquid phase epitaxy and a second solution, separate from the first solution in then brought in contact with the substrate by moving a bubble across the substrate, thereby sweeping the first solution away and an epitaxial layer of a second composition is then grown on the substrate to a desired thickness by liquid phase epitaxy. Cook also discloses the process can be continued until the desired number of epitaxial layers have been grown of the substrate (col 1,ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bernardi and Dugger with Cook's second growth solution because it produces superlattice semiconductor structures for use in electronic and optoelectronic devices (col 1, ln 1-5).

Referring to claim 4, the combination of Bernardi, Dugger and Cook teaches repeating the process of contacting the substrate with the first and second growth solution until a desired thickness is achieved.

Referring to claim 6, the combination of Bernardi, Dugger and Cook teaches a first growth solution, a second growth solution and a substrate at atmospheric pressure and heating the growth solutions above a saturation temperature and cooling to below the saturation

temperature and varying pressure to control the degree of supersaturation, where a bubble moves the first solution out of contact of the substrate prior to contact with the second solution.

Referring to claim 7, the combination of Bernardi, Dugger and Cook teaches repeating the process of contacting the substrate with the first and second growth solution until a desired thickness is achieved.

12. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bernardi (US 4,906,325) in view of Dugger (US 5,503,103) as applied to claims 1-2 above, and further in view of Hsieh (US 4,142,924).

The combination of Bernardi and Dugger teaches all of the limitations of claim 10, as discussed previously in claims 1-2. The examiner interpretes claim 10 to reads as the epitaxial layers comprise III-V epitaxial layers. The combination of Bernardi and Dugger teaches the deposition of mercury cadmium telluride layers, which is not a III-V epitaxial layer.

In a liquid epitaxy method for growing thin films, Hsieh teaches layers of III-V compounds can be formed from liquid phase epitaxy, where III-V semiconductors include GaSb (col 5, ln 5-20). Hsieh also teaches a GaAs wafer **6,** a supersaturated solution of GaAs **8** and the substrate is contacted with the solution to grow a thin film of GaAs on the GaAs wafer at 800°C (col, 3, ln 1-35 and col 2, ln 50-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bernardi and Dugger with Hsieh's growth solution of III-V semiconductor compounds because III-V semiconductors are useful in the opto-electronics industry.

Referring to claim 11, the combination of Bernardi, Dugger and Hseih teaches GaSb.

13. Claims 1 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573).

Hsieh discloses a liquid phase epitaxy growth of GaAs on a GaAs substrate **6** from a solution of GaAs **8**, where the growth is carried out under flowing H_2 (col 2, ln 50-67). Hsieh also discloses the solution and the substrate are heated in an oven substantially above their equilibrium temperature, this reads on applicant's saturation temperature, and the solution and substrate are then cooled in the oven to a temperature below the solution equilbrium temperature, where substrate contacts the solution to form a thin layer of GaAs on the GaAs substrate at a temperature of 800°C (col 3, ln 5-60). Hsieh also teaches layers of III-V compounds can be formed from liquid phase epitaxy, where III-V semiconductors include GaSb (col 5, ln 5-20).

Hsieh is silent to varying the pressure of the system to change the degree of supersaturation of the growth solution.

In a solution growth method for synthesizing crystals, Dugger teaches the degree of supersaturation can be changed by changes in the pressure of the solution or controlled by a temperature of the solution (col 3, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Hsieh with Dugger's pressure change change the degree of supersaturation because control of the supersaturation prevents homnogeneous nucleation in the solution, which prohibits growth on a substrate.

Referring to claim 1, the examiner interpretes the changing of the pressure of the solution to read on applicant's pressure of the system.

Referring to claim 8, the combination of Hsieh and Dugger teaches a temperature of 800°C.

Referring to claim 9, the combination of Hsieh and Dugger teaches a temperature of 800°C.

Referring to claim 10, the examiner interpretes claim 10 to read as a group III-V semiconductor layer. The combination of Hsieh and Dugger teaches GaSb, a group III-V semiconductor.

Referring to claim 11, the combination of Hsieh and Dugger teaches GaSb.

14. Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573) as applied to claim1 above, and further in view of Bernardi (US 4,906,325).

The combination of Hsieh and Dugger teaches all of the limitation of claim 2, as discussed previously in claim 1, except the growth solution and substrate are provided at atmospheric pressure. The combination of Hsieh and Dugger teaches a flow of H_2 is flowed during the growth process but is silent to the pressure.

In a method of forming thin films from solution, Bernardi teaches a hydrogen flow is maintained under atmospheric pressure in order to avoid an oxidative phenomena (col 3, ln 35-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hsieh and Dugger with Bernardi's hydrogen pressure of atmospheric pressure because it avoids oxidation.

Referring to claim 5, the combination of Hsieh, Dugger and Bernardi teaches a first growth solution and substrate under a flow of H_2 at atmospheric pressure and heating to above a saturation temperature and cooling to below the saturation temperature and maintaining at 800°C while varying pressure to control the degree of supersaturation and contacting the substrate with the solution thereby forming a thin film, i.e. solid layer.

15. Claims 3-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (US 4,142,924) in view of Dugger (US 3,933,573) along with Bernardi (US 4,906,325) as applied to claim 2 above, and further in view of Cook (US 4,519,871).

In a method of liquid phase epitaxy, Cook teaches a first solution is contacted with a substrate in a channel and an epitaxial layer of a first composition is grown to a desired thickness by liquid phase epitaxy and a second solution, separate from the first solution in then brought in contact with the substrate by moving a bubble across the substrate, thereby sweeping the first solution away and an epitaxial layer of a second composition is then grown on the substrate to a desired thickness by liquid phase epitaxy. Cook also discloses the process can be continued until the desired number of epitaxial layers have been grown of the substrate (col 1,ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hsieh, Dugger and Bernardi with Cook's second growth solution because it produces superlattice semiconductor structures for use in electronic and optoelectronic devices (col 1, ln 1-5).

Referring to claim 4, the combination of Hsieh, Dugger, Bernardi and Cook teaches varying pressure of a second growth solution controls the degree of supersaturation.

Referring to claim 5, the combination of Hsieh, Dugger, Bernardi and Cook teaches heating above an equilibrium temperature, this reads on applicant's saturation temperature under atmospheric pressure and setting the temperature below the saturation temperature and varying the pressure to control the degree of supersaturation and contacting a substrate with a growth solution, thereby depositing a thin film, i.e. solid layer.

Referring to claim 6, the combination of Hsieh, Dugger, Bernardi and Cook teaches heating above an equilibrium temperature, this reads on applicant's saturation temperature under atmospheric pressure and setting the temperature below the saturation temperature and varying the pressure to control the degree of supersaturation and contacting a substrate with a growth solution, thereby depositing a thin film, i.e. solid layer. The combination of Hsieh, Dugger, Bernardi and Cook also teaches a first growth solution is moved from the substrate by a bubble, this reads on applicant's moving the substrate out of contact with the first growth solution.

Referring to claim 7, the combination of Hsieh, Dugger, Bernardi and Cook teaches repeating steps until a desired thickness is achieved.

Referring to claim 8, the combination of Hsieh, Dugger, Bernardi and Cook teaches a temperature of 800°C.

Referring to claim 9, the combination of Hsieh, Dugger, Bernardi and Cook teaches a constant temperature.

Referring to claim 10, the combination of Hsieh, Dugger, Bernardi and Cook teaches GaAs a group III-V semiconductor, where the examiner interprets claim 10 to read as a III-V semiconductor.

Referring to claim 11, the combination of Hsieh, Dugger, Bernardi and Cook teaches GaSb.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kroes et al (US 5,173,087) teaches cooling in a solution proceeds by thermal diffusion from cold walls to the center of the solution chamber and nucleation will begin where the temperature is the lowest will occur on or near the chamber walls and a temperature gradient will cause crystals to nucleate at different times (col 2, ln 1-40).

Barnett et al (US 4,876,210) teaches supersaturation must be less than that which causes spontanteous homogeneous nucleation of a material in solution as this may prohibit subsequent growth on the substrate (col 5, ln 40-65).

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

mjs
July 25, 2002

Felisa Hiteshew
FELISA HITESHEW
PRIMARY EXAMINER
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